Some Revision in Antechinus (Marsupialia)—1

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SUMMARY

The taxonomy of *Antechinus swainsonii* and *A. minimus* is reviewed. The distribution of each species is mapped. Plastic and cranial characters of major populations are examined and compared statistically.

It is demonstrated that Victorian populations of *A. swainsonii* belong to the subspecies *A. s. mimetes*, and not to the nominate subspecies, *A. s. swainsonii*, of Tasmania.

A mainland Australian population of *Antechinus minimus* is revealed. It is distinguished from the nominate Tasmanian subspecies, *A. m. minimus*, and is given the name *A. m. maritimus* (based on *Phascogale swainsoni maritima* Finlayson).

A. swainsonii favours wet forests, while *A. minimus* favours areas devoid of trees. It is concluded that the former nests in logs and that the latter nests in tussocks. Both are terrestrial, in contrast with the scansorial *A. flavipes*, and many features of *A. swainsonii* indicate its convergence with *Perameles*.

While *A. minimus* has a generally shorter tail and a shorter rostrum than *A. swainsonii*, the short anterior palatine foramina of the former distinguish it absolutely from the latter.

Sexual dimorphism is demonstrated in each species, males being larger than females.

In each species, the nipple number is 6 in the Tasmanian subspecies and 8 in the Australian subspecies.

Taxonomy is revised as follows:

ANTECHINUS SWAINSONII

Antechinus swainsonii swainsonii

(*Phascogale swainsonii* Waterhouse, 1840; Tasmania.)
Tasmania.

Antechinus swainsonii mimetes

(*Antechinus swainsonii mimetes* Thomas, 1924; Guy Fawkes District, New South Wales.)
New South Wales, Victoria.

ANTECHNUS MINIMUS

Antechinus minimus minimus

(*Dasyurus minimus* Geoffroy, 1803; Island in Bass Strait.)
Tasmania, Bass Strait islands.

Antechinus minimus maritimus

(*Phascogale swainsoni maritima* Finlayson, 1958; Port McDonnell, South Australia.)
South-eastern South Australia, south-western Victoria.

I. INTRODUCTION

This study of several members of the genus *Antechinus* was initiated by attempts to identify the species which occur in Victoria.

As with most genera, the classification of *Antechinus* has come about by the piecemeal description of species and subspecies each based on either a single specimen or a very small series. All attempts at comprehensive description of the group have been made by overseas workers (for example, Tate, 1947) hampered by a paucity of study specimens. This has produced a disordered array of "species" and "subspecies".

An understanding of the Victorian members of the genus has necessitated investigation of most species which inhabit the geographical region of Australia defined by Wood and Williams (1960) as the eastern highlands.

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and of related forms in north Australia and the far south-west. A reasonably clear picture has emerged of the populations of these species in temperate Australia, but the situation in the tropics is less clear.

This paper is on the *A. swainsonii* group of species, and it is proposed to deal with the *A. flavipes* group in a further paper.

II. Materials and Methods

(a) *Sources*

The sources of specimens and data are as follows:

American Museum of Natural History.
Australian Museum, Sydney.
British Museum (Natural History).
Fisheries and Wildlife Department, Melbourne.
Muséum National d'Histoire Naturelle, Paris.
National Museum of Victoria.
Queensland Museum, Brisbane.
Queen Victoria Museum, Launceston.
South Australian Museum, Adelaide.
Tasmanian Museum, Hobart.

Antechinus swainsonii and *A. minimus* are poorly represented in most collections, even in the museums of those states in which one or both species occur. Other than a series of approximately 120 of the former in the Fisheries and Wildlife Department collection, there is a total of about 60 specimens of each in the institutions listed. Photographs of the skull of the type of *A. minimus* were provided by the Paris Museum.

(b) *Characters examined*

Morphological features usually regarded as being of taxonomic importance were investigated: size of body and appendages, features of the skull, dentition, pelage and characters of the feet. The plantar aspect of the manus and pes were examined for the number, relative size and position of the striated pads. The form and length of the claws were noted.

The data on all specimens in which the milk teeth (deciduous fourth premolars) persisted or the subsequent permanent fourth premolars were not fully erupted are excluded from the tables of measurements. These specimens are objectively recognizable as juvenile or sub-adult.

External changes indicative of breeding activities in both males and females were noted. Breeding condition is considered to be an important variable as it characterizes a class of adult and also defines a specific period in the life span of an individual.

(c) *Techniques of measurement*

Body measurements

The measurements are those which have been taken in the flesh. All the specimens in the Fisheries and Wildlife Department collection were measured, using a measuring board, vernier calipers and a steel tape, as follows:

Total length: With the animal lying on its back and straightened out, the distance from the tip of the nose to the tip of the tail, excluding any terminal hairs.

Tail length: Length from the center of the cloaca to the tail tip.

Head-body length: The difference between the above measurments.

Pes length: Length from the heel to the tip of the longest toe, excluding the claw.

Ear length: The distance from the tragoid notch to the tip of the ear, excluding hair.

Skull and dentition

In addition to measurements, notes were made on dental and osteological features which appeared to be of diagnostic significance. Of sixteen measurements taken, the seven noted below are examined in some detail in this paper. These were selected as being definitive of species in the eastern Australian group of *Antechinus* with which we are concerned. At the same time these data provide a means of assessing the taxonomic status of related forms.

The following measurements were taken:

Basalar length
Zygomatic breadth
Postorbital constriction
Palatalar length
Anterior palatine foramen (maximum)
Alveolar length of the molar row M^{1-3}.
Breadth at M^3 — the distance between the outer edges of the alveoli of the right M^3 and the left M^3.

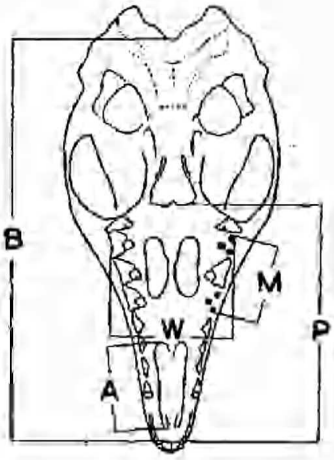
Apart from the last, these measurements are as defined by Cockrum (1955) and as illustrated in Figure 1. All measurements were taken with either a HELIOS dial-reading or vernier calipers, calibrated to 0.05 mm., and with the aid of a binocular microscope at 6 to 10 magnifications.

III. Taxonomy of A. swainsonii

The species was described by Waterhouse (1840) as *Phascogale swainsonii*. The type, a Tasmanian specimen originally in the private collection of W. Swainson, was later acquired by the British Museum (Skin, No. 60. 1. 5. 18; skull, Nos. 60. 1. 5. 26 and 1348.a).

Thomas (1924) established a subspecies, *A. s. mimetes*, based on a specimen from the Guy Fawkes district of north-eastern New South Wales (BM, No. 24. 10. 1. 1; collected by G. H. Wilkins, April 14, 1924).

Iredale and Troughton (1934) recognized these two forms, and gave Tasmania and Victoria as the distribution of the nominate subspecies, and northern New South Wales for Thomas's subspecies. However, distribution data now available demonstrate that there is no major geographical break in the range of *A. swainsonii* on the Australian mainland, and no general morphological division is apparent between the Victorian population and that of northern New South Wales. On the other hand, the mainland group as a whole shows slight morphological variation from that of Tasmania. Therefore the trinomial, *A. swainsonii swainsonii*, should be applied only to the Tasmanian population, while *A. swainsonii mimetes* applies to the whole



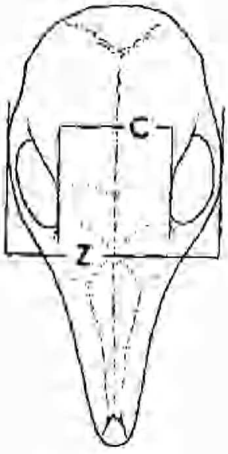


Figure 1
Skull measurements.
B—Basilar Length
Z—Zygomatic Width
C—Postorbital Constriction
P—Palatalar Length
A—Anterior Palatine Foramen
M—Alveolar Length M^{1-3}
W—Breadth at M^3

Victorian and New South Wales population.

Finlayson (1958) discussed a "drab and dull brown" form from south-western Victoria, which he designated as the "Heathmere variant" of his *Phascogale swainsoni maritima* (= *A. minimus*, see section VIII). Although he did not record measurements of the variant, his photographs of the ventral aspect of a skull and of the upper tooth row (plate 1, *loc. cit.*) identify it as *A. swainsonii*. The length of the anterior palatine foramina, extending back to the level of the middle of P^3 and the spacing of the premolars are definitive. Furthermore, an adult skull, Fisheries and Wildlife Department No. D324, a male, taken at Mount Clay near Heathmere, is not distinguishable from *A. swainsonii mimetes*. The pelage of this specimen (see section V(c)) agrees with Finlayson's description of the "Heathmere variant".

Higgins and Petterd (1883, 1884) described several novelties in *Antechinus* (*niger*, *moorei*, *moorei* var. *assimilis*, *rolandensis* and *concinnus*). All were from Tasmania, but apparently the type specimens have been lost. Thomas (1888) and subsequent authors place the first three in the synonymy of *A. swainsonii* and the last two as synonyms of *A. mininus*.

IV. Distribution and Habitat of A. swainsonii

According to the data available, the densest populations of *Antechinus swainsonii* occur in the Otway Ranges and east-central mountain districts of Victoria and in north-western Tasmania, in which areas the annual rainfall is about 40 inches or more per annum. These are regions of wet sclerophyll forest dominated by White Mountain Ash (*Eucalyptus regnans*), and often with stands of Myrtle Beech (*Nothofagus cunninghamii*) and gullies of Soft Tree-fern (*Dicksonia antarctica*). In this habitat *A. swainsonii*

fossicks, bandicoot fashion, amongst the ground litter and in the friable surface soil, for the arthropods and other small animals which comprise its food.

The habitat at Loch Valley, north-western Gippsland, is in a Forests Commission plantation of *Pinus radiata*, with large Mountain Ash logs about the ground and an abundance of bracken and other low scrub. The average annual rainfall is about 56 inches.

Examples caught in the Grampians, western Victoria (R.M.W., 3.11.1962) were amongst ferns in a wet gully under eucalypt forest. A rabbit trap victim was sent from W Tree, eastern Victoria, by L. Hodge, who described the habitat (*in litt.*, 26.8.1963) as a small valley with mixed eucalypt forest, "silver-grass" tussocks and scattered bracken. At Molesworth, south-eastern Tasmania, a specimen was caught (N.A.W., 21.1.1962) amongst treeferns and shrubbery along a creek through an area of light forest. These habitats are probably typical of the scattered occurences of *A. swainsonii* in western and eastern Victoria, eastern Tasmania and eastern New South Wales. They indicate that the species occurs in small areas of suitable habitat, rather than its having a general distribution throughout regions of drier forests.

No information is available about actual homes of these phascogales in the forest habitats, but we believe they make nests close to ground level, in hollow logs and the butts of partly dead trees. (The nests described by Fleay (1932) as belonging to *A. swainsonii* are those of *A. stuartii*, the latter species having been confused with others prior to the present study).

A few specimens of *A. swainsonii* have been trapped in habitats quite different from those already described. Near Portland, south-western Victoria, one was caught (R.M.W., 9.1.1962) in flat, sandy terrain in open woodland, on tunnel-like runways through a dense tangle of wiry grass. At Port Campbell, west of the Otway Ranges, another was taken (N.A.W., 17.12.1962) amongst large tussocks of Coast Saw-sedge (*Gahnia trifida*) between a coastal swamp and an area of stunted banksia and eucalypt scrub. From Lakes Entrance, eastern Victoria, specimens have been received, which were caught on the narrow strip of scrub-covered sand dunes between Lake King and the ocean. As the last two habitats are devoid of logs which could be used as homes by the phascogales, it must be assumed that in these areas they make nests in tussocks of saw-sedge and in thickets of grass.

Besides the type, there are five Tasmanian specimens in the British Museum: three from Magnet (near Waratah), one from Henty River and one from Table Cape. The species has never been authentically recorded from any island, either in Bass Strait or elsewhere off Tasmania.

Distribution of *A. swainsonii* is shown in Figure 2.

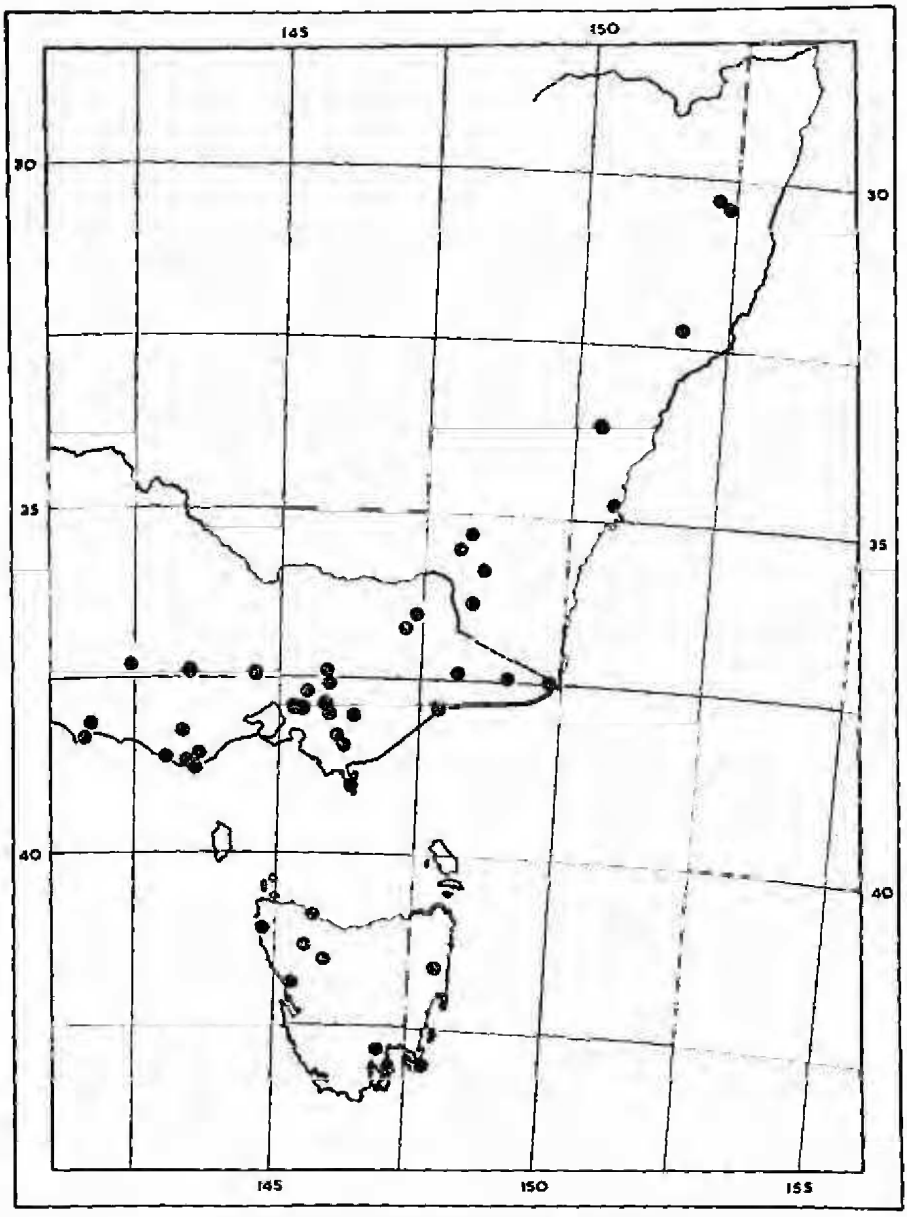


Figure 2: Distribution of *Antechinus swainsonii*.

V. Plastic Characters of A. swainsonii

Troughton (1941) described *A. swainsonii* as one of the more sturdily built species of the genus and drew attention to its particularly slender snout. Compared with other small forest dwelling dasyurids, it is thickset and heavy in the hind quarters. The tail is conspicuously shorter than the body. The largest Victorian specimen in the F.W.D. collection, a male, weighed 128 gm; the largest female weighed 65 gm. The ears are relatively small and are partly hidden by the body fur. The fore claws are long and broad (see Figure 3) and, according to our observations, are used for digging in a manner similar to that of bandicoots. The foot pads are smaller, less prominent and usually one less in number than in other forest-dwelling species of *Antechinus*. Most of these features of *A. swainsonii* are in contrast with those of the scansorial *A. flavipes* group and appear to be adaptations to a terrestrial existence.

(a) *Body Measurements*

The data of body measurements are derived from a series of 57 males and 70 females. Specimens from the geographical extremities of the species range are represented, but the bulk of the series is from Loch Valley in eastern Victoria (38° 00′ S, 145° 33′ E.) Head-body, tail, ear and pes lengths are set out in Table 1. Though the averages indicate that males are larger than females, the body proportions of the sexes are virtually identical. Head-body length and pes length are selected for statistical evaluation of sexual dimorphism within each of the major geographically isolated populations (figure 2). Tables 2 and 3 set out the relevant data from the mainland and Tasmanian series. Data from the Loch Valley series are included in the table to show the observed variation in a reasonably large sample from a small area of relatively uniform habitat.

As the frequency distributions of these variables are approximately "normal", the "t" test of significance, as outlined in Karmel (1959), is used for the comparisons. Males from both the Tasmanian and mainland populations have a significantly greater head-body length than females ($P < 0.001$ in both cases). The values of P were obtained from Fisher and Yates (1957). The same data do not demonstrate any significant difference between the two populations.

Again, males of both populations are found to have a significantly greater pes length ($P < 0.001$ in both cases) than the female. A significant difference in pes length between the two series of males could not be demonstrated ($P = 0.3$). However, mainland females do significant difference between have a significantly longer pes than Tasmanian females ($P < 0.001$). When pes length is expressed as a percentage of head-body length it shows no the two populations, in either sex.

TABLE 1

Comparison of body measurements of males and females of *A. swainsonii.*

	Males (57)			Females (70)		
Head-body length	97 — 145	(123.1)		99 — 140	(116.0)	
Tail length	76 — 124	(98.4)	80%	73 — 104	(88.5)	77%
Ear length	12.5— 19	(16.4)	13%	12.5— 18.5	(15.3)	13%
Pes length	18 — 23.5	(21.5)	17%	17 — 22	(20.0)	17%

TABLE 2

Comparison of head-body length of Tasmanian and Australian mainland populations of *A. swainsonii.*
Measurements in millimetres.

		Range	Mean ± S.E.	Standard Deviation
Tasmania	9 ♂♂	102 — 134	117.4 ± 1.06	3.19
	13 ♀♀	99 — 127	112.2 ± 0.77	2.78
Australian mainland	46 ♂♂	97 — 145	124.2 ± 1.58	10.71
	57 ♀♀	101 — 140	116.8 ± 1.18	8.88
Loch Valley	21 ♂♂	109 — 145	127.9 ± 2.02	9.25
	37 ♀♀	101 — 133	114.1 ± 1.09	6.62

TABLE 3

Comparison of pes length of Tasmanian and Australian mainland populations of *A. swainsonii.*
Measurements in millimetres.

		Range	Mean ± S.E.	Standard Deviation
Tasmania	10 ♂♂	20 — 22	21.2 ± 0.29	0.92
	13 ♀♀	17 — 21	19.0 ± 0.27	0.97
Australian mainland	47 ♂♂	18 — 23.5	21.6 ± 0.17	1.15
	47 ♀♀	18 — 22	20.2 ± 0.15	1.03
Loch Valley	20 ♂♂	20 — 23.5	21.8 ± 0.21	0.95
	37 ♀♀	18 — 22	20.0 ± 0.14	0.86

(b) *Manus and pes*

Finlayson (1958, p. 147) gives a good account of the features of the manus and pes of *A. swainsonii.* The appearance of the plantar surface as in Figure 3 is typical of the species.

In *Antechinus* the maximum number of foot pads is normally six*, four interdigitals at the base of the digits and two additional pads, often variable in form, lower down on the palm or sole. In the past, a confusing variety of terms has been used in describing these pads in the Dasyuridae. They were referred to by Jones (1923, p. 8) as thenar — on the inner side of the foot below the first interdigital, and hypothenar — on the opposite side. Finlayson

*The presence of super-numerary minute, striated pads has been noted in *A. flavipes* and related forms.

(*loc. cit.*) used inner metacarpal (-tarsal) instead of thenar and outer metacarpal (-tarsal) for hypothenar. In some species of *Antechinus* the inner metatarsal is fused with the first interdigital, resulting in a single long pad extending from the base of the hallux. Thomas (1888, p. 285) termed this the hallucal, whereas Finlayson (*loc. cit.*, p. 147) restricted that term to the first interdigital alone. Finlayson's terminology is used throughout this paper.

The normal appearance of the plantar aspect of the palm is shown in Figure 3. The inner metacarpal and first interdigital are completely fused. In a series of 75 *A. swainsonii*, drawn largely from Victoria and Tasmania, this condition was noted in 97% of cases. Figure 3 shows

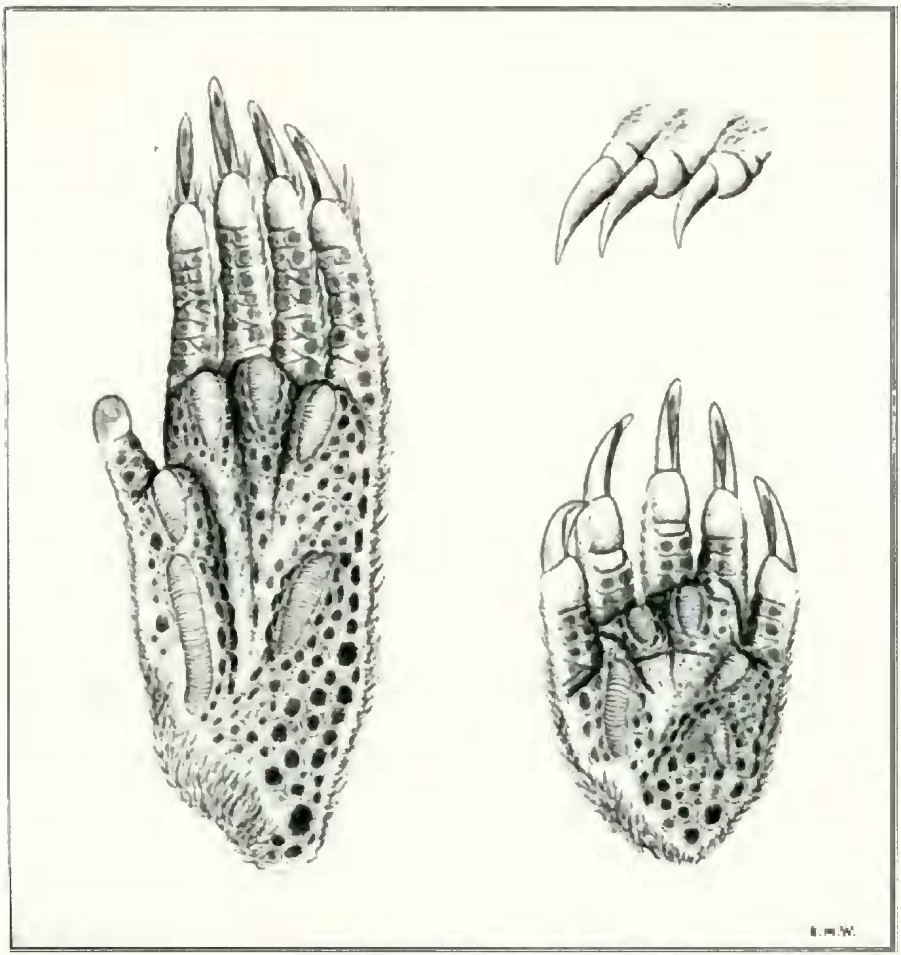


Figure 3: Foot characters of *Antechinus swainsonii*. *Left*—Left pes. *Lower right*—Left manus. *Upper right*—Foreclaws.

the plantar aspect of the pes, with the hallucal and inner metatarsal pads distinctly separate. Finlayson (*loc cit.*, p. 147) noted fusion of these two pads in 4 out of 16 specimens and commented that "the fusion of the original elements is always made obvious by a constriction at the site". In 73 specimens of the above series examined for this feature, complete fusion was noted in 32 (44%), and in many of these no constriction was evident. In 10 specimens (14%) the pads were fused on one pes only and the remaining 31 (42%) showed complete separation on each pes.

(c) *Pelage*

The main pile is dense, moderately soft and about 10 mm in length mid-dorsally, the tips providing the general dorsal colour of deep brown. Bronze flecks are apparent under suitable lighting, due to a narrow band of that colour below the tip of each hair; the basal zone is deep slate. There is little anteroposterior differentiation, but the rump and flanks usually have a warmer tone than the head and shoulders. The guard hairs are about 15 mm long and are glistening black for the distal third of their length, imparting a sheen to the coat. The ventral fur is uniform greyish white at the tips and slate beneath. Orbital crescents are either absent or ill defined. The ears, manus and pes are of the same colour as the head and shoulders. The tail is short-haired, slightly darker above; the dorsal fur near the base is similar to that of the rump.

Several colour variations have been noted. The coastal specimens from Lakes Entrance and Port Campbell are drab, with the rump, flanks and upper base of tail a warmer brown. The western Victorian population (Grampians and Portland area) are greyish brown lightly flecked with dull fawn, giving a grizzled appearance.

A single instance of melanism was noted in a male from Erica, Victoria (N.M.V., No. C. 1395).

VI. Skull and Dentition of A. swainsonii

According to Tate (1947, p. 132) *A. swainsonii* and *A. minimus* form a strongly specialized division of the genus. They are very similar in most features but the greater degree of modification has occurred in *A. swainsonii*.

In describing the skull and dentition of *A. swainsonii*, *A. flavipes* has been selected as a standard for comparison because it is regarded as one of the least specialized members of the genus (Jones 1923, p. 98). The skull of *A. swainsonii* is shown in Figure 4; and features of it are compared with those of *A. flavipes* in Table 4.

The molars of *A. swainsonii* are smaller than those of *A. flavipes* but are otherwise very similar.

In *A. swainsonii*, the milk premolar (dP^4) is much reduced in size. It is a low-crowned tooth with three roots and is molariform. By comparison dP_4 is appreciably smaller. It has two roots and, except for its low crown, resembles the permanent premolars.

TABLE 4

Comparison of cranial characters of *A. swainsonii* with those of *A. flavipes*

A. swainsonii	*A. flavipes*
Long, narrow rostrum.	Short, broad rostrum.
Anterior palatine foramina not less than 4·60 mm.	Anterior palatine foramina not more than 3·70 mm.
Postorbital constriction broad in proportion to the zygomatic breadth, sides approximately parallel.	Postorbital constriction narrow in proportion to zygomatic breadth, sides not parallel.
Frontal-nasal area concave to straight in lateral aspect.	Frontal-nasal area convex in lateral aspect.
Mandible long; anterior portion narrow.	Mandible short; anterior portion broad.
I^1 of medium size, in contact with I^2, only slightly procumbent.	I^1 large, widely separated from I^2, markedly procumbent.
I^1 slightly compressed laterally, with a well defined inner cutting edge in line with I^{2-4}, in close occlusion with I_1.	I^1 not compressed, without cutting edge, not in close occlusion with I_1.
I^{2-4} compressed laterally, slightly elongated antero-posteriorly, not crowded.	I^{2-4} not compressed, rounded in form, crowded.
Slight descending size gradient from I^2 to I^4, adjacent incisors may be subequal.	Well marked descending size gradient from I^2 to I^4.
Anterior lower incisors markedly procumbent.	Anterior lower incisors less procumbent.
I^3 bears small accessory cusp on buccal aspect near heel, slightly overlapping the canine.	Accessory cusp scarcely differentiated or absent.
Upper canine compressed laterally, usually with a pronounced curve.	Upper canine a broad tapered peg, slightly curved.
Upper premolars compressed laterally, elongated antero-posteriorly; space on each side of P^1.	Upper premolars broad, not elongated anteroposteriorly; P^1 not separated from adjacent teeth.
Lower premolars compressed laterally.	Lower premolars not compressed laterally.

The lower deciduous teeth are lost first, generally by early December, when the animal is about 4 months old, but dP_4 has been found as late as February, persisting at the rear of the erupting P_4.

Table 5 provides comparative measurements of the skull and teeth of the Tasmanian and mainland series, and of a series from Loch Valley, Victoria. Again, the latter set is given because it represents a large

sample from a small area of relatively uniform habitat.

In corresponding measurements, the Tasmanian and mainland series are very similar, and their skull proportions are almost identical. The test of significance, as used previously, shows that the only statistically valid difference between the two series is in length of the anterior palatine foramen ($P < 0.001$). However, in scanning individual measurements of the palatine opening in mainland skulls, some variation is noted in this feature from place to place. A comparison of local populations was restricted to those represented by skull series. Four specimens from the Guy Fawkes district* of New South Wales (30° 25'S, 152° 20'E), at the northern limit of the distribution, averaged 5·00 ± 0·16 mm. In Victoria, the Loch Valley series averaged 5·31 ± 0·02 mm; eight specimens from the Dandenong Ranges (37° 51'S, 145° 22'E) 5·78 ± 0·09 mm; and twelve specimens from Mount Macedon (37° 24'S, 144° 34'E) 5·15 ± 0·06 mm. Only the Dandenongs series differs markedly from the average of the whole mainland series. The interpretation of these results is severely restricted by the small size of three of the samples and the paucity of comparative material from the western limits of the distribution. In any case it is not known to what extent these samples represent geographically isolated populations. A possible relationship between the Dandenongs and Tasmanian populations is not borne out by test ($P < 0.01$ for the difference). These findings are the basis of the adjustment suggested in section III, to the major subspecific division which has been recognized in the species, e.g. by Iredale and Troughton (1934) and Finlayson (1958).

It certainly appears that *A. swainsonii* and similar species are more specialized in many features, and this premise is accepted by us as a basis for the following discussion.

Most of the modifications noted in *A. swainsonii* occur also, in various combinations, in other small dasyurids. Elongation of the rostrum is noted in *Neophascogale*, *Phascolosorex* and *Antechinomys*. In the last two genera the incisors are of the same pattern as in *A. flavipes*. In *Neophascogale* the incisors are modified as in *A. swainsonii* but in the former I^1 has reached a stage where it is identical in shape with I^{2-4} (Tate 1937, 1947). The accessory cusp on I_3 in *A. swainsonii* has not been noted by other authors (for example, Tate (1948, p. 317) stated that a bifid I_3 is universal in the Peramelidae and is not found in other related families). In *Perameles gunnii*, the additional cusp is conspicuous and functional in occlusion, shearing past the faintly triangular crown of I_4. In *A. swainsonii* it is inconspicuous and functions imperfectly because of the close proximity of the canine. In *A. swainsonii* (and more so in *Neophascogale*) the arrangement of I^{1-4} approximates closely to that of *Perameles gunnii*.

*The type locality of *Antechinus swainsonii* mimetes.

TABLE 5

Cranial Measurements of *A. swainsonii*.
(in millimetres)

	Tasmania				*Australian Mainland*				*Loch Valley*			
	No. of Specimens	*Range*	*Mean ± S.E.*	*Stand. Deviation*	*No. of Specimens*	*Range*	*Mean ± S.E.*	*Stand. Deviation*	*No. of Specimens*	*Range*	*Mean ± S.E.*	*Stand. Deviation*
Basalar Length (B.L.)	13	25·85—28·90	27·70±0·23	0·839	78	26·15—31·30	28·27±0·13	1·155	42	26·60—30·10	28·20±0·17	1·104
Zygomatic Breadth (Z.B.)	13	14·50—16·10	15·64±0·14	0·513	77	14·50—18·25	16·19±0·09	0·817	43	14·90—18·25	16·04±0·12	0·819
Postorbital Constriction (P.C.)	14	7·20— 7·85	7·66±0·05	0·180	88	7·20— 8·60	7·89±0·09	0·851	47	7·40— 8·60	7·92±0·04	0·287
Palatalar Length (P.L.)	14	14·70—16·55	15·71±0·12	0·459	89	14·45—17·20	15·62±0·06	0·611	48	14·70—16·65	15·71±0·08	0·546
Anterior Palatine Foramen	14	5·70— 6·65	6·12±0·06	0·248	90	4·60— 6·35	5·33±0·05	0·492	48	4·60— 6·20	5·31±0·05	0·345
Breadth at M^3 (B.M.)	14	8·60— 9·20	8·93±0·05	0·169	90	8·30—10·00	8·90±0·04	0·344	50	8·30— 9·40	8·78±0·03	0·236
Length, M^{1-3}	14	5·10— 5·75	5·43±0·05	0·177	91	5·00— 6·20	5·46±0·02	0·218	50	5·00— 5·70	5·31±0·02	0·162
P.C./B.L., as percent.	13	26·4 —28·6	27·6 ±0·20	0·715	78	24·4 —29·5	27·6 ±0·13	1·162	42	24·5 —29·5	28·02±0·12	0·746
Z.B./B.L., as percent.	13	54·8 —59·0	56·5 ±0·37	1·370	75	52·2 —60·8	56·6 ±0·20	1·721	42	53·9 —60·6	56·92±0·23	1·481
P.L./B.L., as percent.	13	54·6 —58·1	56·5 ±0·27	0·967	78	53·4 —57·7	56·0 ±0·11	0·938	42	53·4 —57·3	55·90±0·16	1·051
B.M./B.L., as percent.	13	31·0 —33·6	32·2 ±0·25	0·890	77	28·4 —34·6	31·6 ±0·14	1·245	42	28·4 —32·6	31·06±0·14	0·917

TABLE 6

Cranial measurements of *A. minimus*.
(in millimetres)

	Maatsuyker Island				*Tasmania*				*Australian Mainland*			
	No. of Specimens	*Range*	*Mean ± S.E.*	*Stand. Deviation*	*No. of Specimens*	*Range*	*Mean ± S.E.*	*Stand. Deviation*	*No. of Specimens*	*Range*	*Mean ± S.E.*	*Stand. Deviation*
Basalar Length (B.L.)	14	24·60—26·90	25·89±0·18	0·680	13	23·60—29·60	26·92±0·48	1·740	10	25·40—29·14	27·97±0·41	1·295
Zygomatic Breadth (Z.B.)	12	14·80—16·20	15·64±0·12	0·429	13	14·20—17·70	15·50±0·24	0·882	11	15·60—18·10	17·16±0·23	0·770
Postorbital Constriction (P.C.)	14	7·00— 7·50	7·29±0·05	0·174	16	7·10— 8·50	7·47±0·10	0·386	11	7·00— 7·80	7·37±0·07	0·243
Palatalar Length (P.L.)	13	13·60—14 65	14·29±0·09	0·326	14	13·20—15 40	14·29±0·17	0·637	11	14·20—15·90	15·27±0·05	0·173
Anterior Palatine Foramen	14	3·60— 4 00	3·77±0·04	0·140	16	3·30— 4·40	3 75±0·07	0·288	11	3·35— 4·00	3·68±0·08	0·272
Breadth at M^3 (B.M.)	14	8 90— 9·25	9·09±0·03	0·114	15	8 40— 9 75	8 93±0 10	0·392	11	9·20—10 20	9 65±0·08	0·263
Length, M^{1-3}	14	5·00— 5·30	5·14±0·02	0·087	16	4·90— 5·35	5·08±0·03	0·134	11	5 10— 5·45	5·32±0·03	0·113
P.C./B.L., as percent.	14	27·0 —28·9	28·0 ±0·13	0·486	13	27·2 —30·3	28 9 ±0·27	0·978	10	24 6 —29·1	26·4 ±0·71	2·230
Z.B./B.L., as percent.	12	56·0 —62·5	60·1 ±0·48	1·663	13	54 9 —61·5	59 7 ±0·31	1·853	10	59·0 —63·1	61·2 ±0·43	1·371
P.L./B.L., as percent,	13	53·1 —58·2	55·1 ±0·32	1·170	12	53·5 —56·9	55·6 ±0·20	0·975	10	52·6 —55·9	54·5 ±0·32	1·011
B.M./B.L., as percent.	14	33·0 —36·6	34·9 ±0·21	0·789	13	32·9 —35·6	34·5 ±0·26	0·938	10	32·2 —38·2	34·4 ±0·63	1·974

The above evidence, and other which is discussed in Sections V and X suggests a convergence of *A. swainsonii* with *Perameles*.

VII. Breeding Condition in A. swainsonii

Females

In the series trapped over a period of six years at Loch Valley, Victoria, 35 females provided information on breeding. As in other *Antechinus* so far studied (Fleay, 1949; Horner and Taylor, 1959; Marlow, 1961) breeding in *A. swainsonii* is restricted to a short period in late winter. In Loch Valley animals, birth occurs at about mid-August. Little variation in the date was observed for the years 1957, 1960 and 1961, for which data are available. The earliest dates of occupation of the pouch area in those years were August 14, 17 and 17 respectively.

In the non-breeding condition, which obtains for most of the year, the pouch area is inconspicuous and with no definition of the margins. Its position is marked by a patch of whitish hairs which, unlike the ventral fur, are of uniform colour throughout their length. The nipples are usually difficult to find as they are quite minute and are obscured by this patch of fur.

In late July, presumably during pregnancy, the pouch area enlarges and becomes defined by lateral ridges of skin. The earliest litter recorded at Loch Valley was of eight young, which averaged 6.5 mm in crown-rump length. The earliest date of capture of a lactating female not carrying young was October 11. Presumably the young had been left in the nest. At this stage the pouch area is at maximum development. It is roughly triangular in shape with the apex backward. The anterior border is marked by long reddish-brown hairs. The skin of the mammary area is granular and almost devoid of hair. The nipples are arranged symmetrically, parallel to the lateral ridges of skin. In all mainland specimens examined, the number of nipples was eight; in the four Tasmanian specimens for which a count was possible, the number was six.

Males

The only external sign of sexual maturity in males is the size of the testes. During the period of sexual immaturity the scrotum is small and is partly concealed by ventral fur. In June the testes are at maximum size and the pendulous scrotum is very conspicuous—approximately one month before pouch development in the female.

VIII. Taxonomy of A. minimus

This species was originally described by Geoffroy (1803) as *Dasyurus minimus*, and it is the earliest published species of those currently recognized in the genus *Antechinus*. The type description is in *Bulletin des Sciences par La Societé Philomathique de Paris* No. 81., the date of which is given by Iredale and Troughton (1934) as "1803 . . . . December (*fide*

Sherborn)." Later, Geoffroy (1804) amplified the description in *Annales du Muséum d'Histoire Naturelle.*

Both descriptions of *A. minimus* simply compare it with large dasyures and so are not specifically diagnostic in *Antechinus*. However, the pelage is stated to be *roux* (= reddish, russet).

The type is in the Muséum National d'Histoire Naturelle, Paris, and of it Dr Jean Dorst reports (*in litt.*, 7.6.1962):

> This specimen is mounted and the skull, withdrawn from the skin, is kept separately. It is in fairly good condition for its age. It was brought back by Peron and Lesueur (from the) expedition of the "Corvette le Naturaliste" and (is) kept under the number 381.
>
> The colouration of the specimen is brownish all over the upper parts; the under parts are lighter. The tail is blackish brown, and has only a few hairs bristle-like. The fur is worn out and is fallen in some parts. The pelage seems only a little faded by light.

Photographs of the skull and mandible of the type specimen have been obtained. These confirm the identity of the populations that are treated in this paper as *Antechinus minimus*. In particular the anterior palatine foramina are short (see Figure 5 and Section XI).

As regards the type locality of *A. minimus*, Geoffroy (1803) stated that "M. Péron l'a trouvé dans une île placée dans le detroit de Bass". This detail has apparently escaped the notice of authors dealing with the species; Iredale and Troughton (1934) simply gave "Tasmania" for the type.

Waterhouse (1846) cited *Annales du Muséum* for the original description of the species, and he indicated that Maria Island was the type locality. (In the *Annales*, Geoffroy had omitted the locality data). Waterhouse's error evidently arose from a statement by Péron (1807, p. 359), who, in his record of the expedition's sojourn at "l'île Maria", wrote:

> Dans la classe des mammiféres, je n'ai pu voir qu'une seule espéce de Dasyure, de la grosseur à peine d'une souris; j'ai reçus un individu vivant, . . ."

In 1818, Desmarest described *Phalangista nana* (= *Cercartetus nanus*), giving the locality as "L'ile Maria" and the size as "Deux pouces et demi environ de longeur". Waterhouse (1846, p. 309) stated that the specimen was "procured by M. Péron at Maria Island" and that it was of the bulk of the Common Mouse.

Evidently the type specimen of *Cercartetus nanus* was the "dasyure" collected by Péron on Maria Island.

In Péron's *Voyage de Decouverte aux Terres Australes*, there is only one entry that could apply to the type specimen of *Antechinus minimus*. This is in volume I., on page 359, in a quoted report by M. Bailly, who had charge of a small party for several days. The relevant extract translates as follows:—

> . . . . a species of small animal, which the crew did not fail to call rats, but which everything indicates ought to belong to a genus or even an order quite different. These animals have long silky hair; their colour is a yellowish grey; they are besides so little shy, that they came

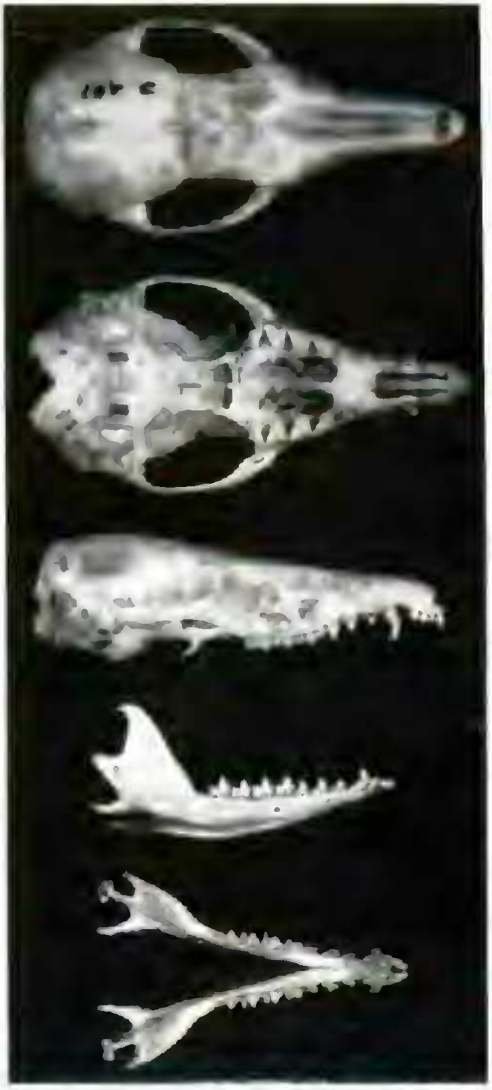
right amongst us to eat the debris of our meal. One of our sailors took one of them with his hand, without the animal appearing to be frightened.

The locality was Waterhouse Island, which lies close to Tasmania towards the eastern end of Bass Strait; and the episode occurred in the late evening of March 17, 1802.

Gray (1841) described a specimen from the Tasman Peninsula, south-eastern Tasmania, as *Phascogale affinis*. Thomas (1888) and subsequent authors placed this in the synonymy of *A. minimus*. The type of *A. affinis* is in the BM (No. 41. 1241 and 316.a), and cranial measurements which were sent from there to us support Thomas's action (for example, the anterior palatine foramina were given as 2.9 mm long).

Our identification of the Tasmanian population as the nominate subspecies, *A. minimus minimus*, is based on the assumption that the type of *A. minimus* was a specimen of this population. As that type specimen was subadult, and because there are insufficient specimens from Bass Strait islands for statistical tests, this assumption is made on circumstantial evidence only. Points taken into consideration are, firstly, the probability that Waterhouse Island *is* the type locality, and secondly, that the faunal relationships of the Bass Strait islands are with Tasmania rather than with the Australian mainland.

Finlayson (1958) published data of a series of *Antechinus* from coastal tracts of south-eastern South Australia and



(*Photos: J. Cooper, F.W.D.*)

Figure 4: Skull and mandible of an adult male *Antechinus swainsonii mimetes* from Loch Valley, Victoria (F.W.D., No. D.487).

south-western Victoria. He named them *Phascogale swainsoni maritima*, and designated as the type a specimen from Port MacDonnell (S. Aust. Mus., No. M.4985, *leg.* G. Tilley,

(*Photos: J. Cooper, F.W.D.*)

Figure 5: Skull and mandible of the type of *Antechinus minimus maritimus*, an adult male (S.A.Mus., No. M.4985).

(*Photos: Paris Museum*)

Figure 6: Skull and mandible of the type of *Antechinus minimus minimus*, a sub-adult with fourth premolars erupting.

June 1938). Some of the measurements he gave — for example, 3·0-5·5 mm. for the anterior palatal foramina — indicate that the series contained both *A. swainsonii* and another species. Though most of this series has not been available to us, the type has been examined and identified as *A. minimus* (see Figures 5 and 6).

As the Australian *A. minimus* differs in minor characters from the Tasmanian form, it is con-

venient to recognize Finlayson's subspecific name. The mainland population is therefore distinguished as *A. minimus maritimus*. However, Finlayson's "Heathmere variant" (which is a form of *A. swainsonii*) must be excluded from this taxon (see Section III).

IX. Distribution and Habitat of A. minimus

Besides the type of *A. affinis*, from Tasman Peninsula, the British Museum has specimens of *A. minimus* from Scottsdale and Hummock Island. In Australian museums, there are specimens from several other islands of Bass Strait and from Maatsuyker Island, off southern Tasmania. Most other specimens from Tasmania, and all from the Australian mainland, were from close to the coast, indicating that the typical habitat of the species is coastal (see Figure 7). Though properly understood by Thomas (1888) and Tate (1947), *A. minimus* has been confused in Australian collections and literature with *A. swainsonii* and other small dasyurids. For instance, the animal described by Guiler (1960) as *A. minimus* is, in

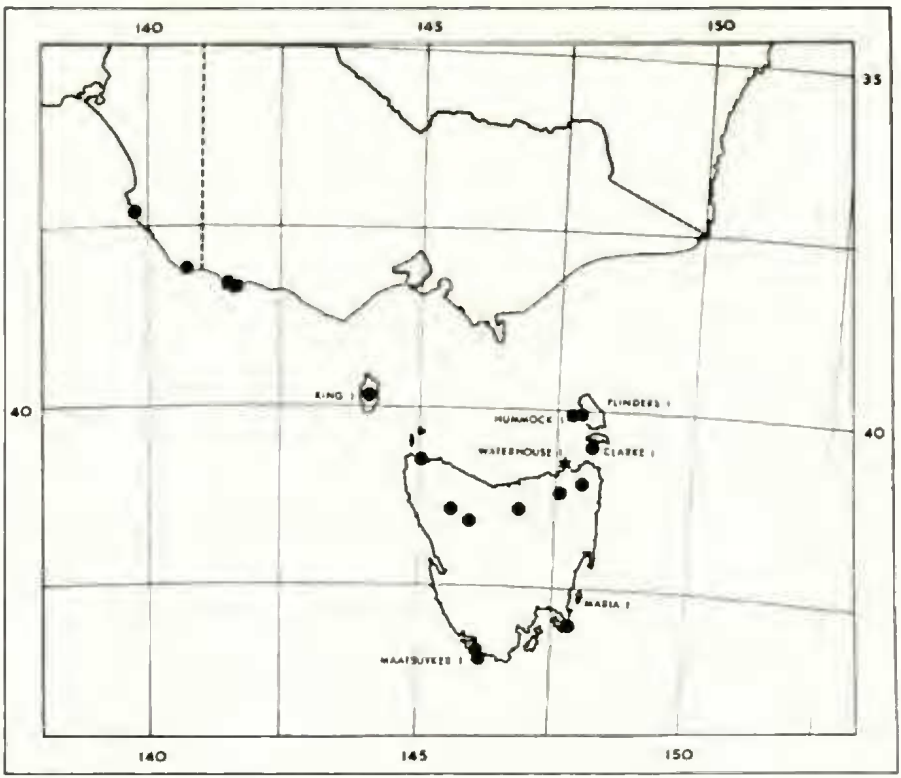


Figure 7. Distribution of *Antechinus minimus*. (Probable type locality indicated by star.)

fact, *Sminthopsis leucopus*. Because of these misunderstandings, the comment by Troughton (1941) that "no habitat notes are available for the species", remained true until last year.

Two specimens of *A. minimus* were eventually caught (N.A.W., 30.6.1962) at Bridgewater Lakes, near Portland, south-western Victoria. The habitat was near a small lagoon amongst a shrubbery of tall tea-tree (the Moonah, *Melaleuca pubescens*), with areas of dense ground coverage. They entered traps which were on damp ground under a thicket of large tussocks of Coast Sawsedge (*Gahnia trifida*) and within six feet of the water's edge. The area was sand-dune, devoid of eucalypts, and, in the complete absence of other shelter, it is certain that the phascogales there must make their nests in the *Gahnia* tussocks.

In captivity, these specimens were provided with bundles of wiry grass and sedge, and they were quite adept at making nests, by getting into the material and then pulling the strands round themselves.

Similar conclusions were reached this year by R. H. Green of the Launceston Museum, based on his experience in trapping both *A. swainsonii* and *A. minimus* near Waratah in north-western Tasmania, in a locality where open areas of "button-grass" (*Gymnoschoenus sphaerocephalus*) give way to forests of Myrtle Beech (*Nothofagus cunninghamii*). Green summarized his observations (*in litt.*, 11.9.1963) as follows:

> All *Antechinus* taken in button-grass were *A. minimus* and all taken in the myrtle forest were *A. swainsonii*. However, *A. minimus* was taken in thick scrub bordering button-grass, but none of this species was taken actually in the rainforest. There was in one area a short dense growth of fine marshy grass in which we caught *A. minimus* on pads. As for their nests, I consider they build in the dense grass or in the centres of the larger button-grass bushes. There is simply no other suitable place.

X. Plastic Characters of *A. minimus*

(a) *Body Measurements*

Table 7 sets out the data of body dimensions derived from 18 male and 17 female adult specimens from throughout the range of the species. Although of similar proportions to *A. swainsonii*, *A. minimus* is a smaller animal. The greatest weights recorded for specimens of *A. minimus* are 55 gm for a Tasmanian male and 43 gm for a mainland female. A marked difference between the two is in length of tail, which in *A. minimus* measures about 70 per cent. of head-body length, compared with about 80 per cent. in *A. swainsonii*. A live specimen of *A. minimus* is shown in Figure 8.

A comparison of head-body length of the Tasmanian and Maatsuyker series is set out in Table 8. A close similarity is obvious. As corroborative evidence, cranial measurements of the two forms are practically identical (Section XI). Table 9 shows a comparison of the combined series from Tasmania and

Maatsuyker (presumably the nominate subspecies) with the mainland sample. However, because only one of the mainland specimens is female, the statistical comparison is restricted to males. Despite the small and variable series, the difference between the means was found to be highly significant ($P < 0{\cdot}001$). The pes lengths as absolute measurements are closely comparable; as proportions of head-body length they show divergence, but this is not statistically significant.

The differences between sexes could be tested only in the Tasmania-Maatsuyker series (see Table 10). In head-body length males are larger than females, but only at the 1·0 per cent. level of significance. Though the evidence is inconclusive, due to the small size of the samples, the observed difference is in keeping with marked sexual dimorphism found by us in *A. swainsonii* and by Horner and Taylor (1959) in members of the *A. flavipes* group.

(b) *Manus and pes*

Figure 3, drawn from a specimen of *A. swainsonii*, shows the normal appearance of the manus and pes of *A. minimus* equally well. The only quantitative difference between the feet of these species is merely the frequency of fusion of the first interdigital and inner metacarpal (-tarsal) pads and is of no value in identification of individuals. In *A. swainsonii* fusion occurs more than twice as frequently as in *A. minimus*. This is demonstrated in Table 11. This result is at variance with Finlayson's findings (*loc. cit.*, p. 149), due possibly to his series of *"Ph. s. maritima"* containing some *A. swainsonii*.

Tate (1947) commented on the prevalence of striated pads in forest-dwelling mammals, mentioning marsupials, tree shrews (Tupaiidae), primates and certain of the rodents. This, he infers, indicates arboreal habits, or at least, arboreal ancestry. The lack of striations in some living species of these orders is suggested by Tate to be "an adaptive condition superimposed on ancestral lines that earlier had striated pads." Tate showed that the Dasyuridae are more variable in this respect than other marsupial families but noted that most dasyurid genera possess striatae.

All *Antechinus* possess striated pads. However, in both *A. swainsonii* and *A. minimus* there appears to be a tendency towards reduction in the number of pads. This is in contrast to more typically forest-dwelling species of the *A. flavipes* group, in which the pads are strongly developed and fusion is exceptional.

In both *A. swainsonii* and *A. minimus* there is a pronounced elongation of the claws, particularly those of the manus, which in *A. swainsonii* may exceed 5 mm. As Finlayson (*loc. cit.*) noted, the claws of both species are broader and less curved (see Figure 3) than in *A. flavipes*. *Neophascogale*, of similar dentition to *A. swainsonii*, also has similar claws (*vide* Tate & Archbold, 1937).

TABLE 7

Comparison of body measurements of males and females of *A. minimus*.

	Males (18)			Females (17)		
Head-body length	103 — 140	(118.7)		98 — 117	(106.5)	
Tail length	65 — 100	(81.2)	69%	67 — 85	(74.6)	70%
Ear length	13 — 17	(14.7)	12%	13 — 15	(13.9)	13%
Pes length	16 — 22	(18.7)	16%	17 — 19	(18.0)	17%

TABLE 8

Comparison of head-body length of Tasmanian and Australian mainland *A. minimus*.

		Range	Mean ± S.E.	Standard Deviation
Tasmania	6 ♂♂	103 — 122	113.2	
	5 ♀♀	101 — 117	106.6	
Maatsuyker Island	5 ♂♂	108 — 120	115.8	
	6 ♀♀	94 — 114	104.8	
Combined Series (Tasmania and islands)	11 ♂♂	103 — 122	113.5 ± 1.70	5.65
	11 ♀♀	94 — 117	105.6 ± 2.13	7.05
Australian mainland	6 ♂♂	118 — 140	128.3 ± 3.14	7.70
	1 ♀		(116.0)	

TABLE 9

Comparison of pes length of Tasmanian and Australian mainland *A. minimus*.

		Range	Mean ± S.E.	Standard Deviation
Combined series (Tasmania and islands)	12 ♂♂	16 — 22	18.7 ± 0.40	1.37
	16 ♀♀	17 — 19	18.1 ± 0.30	1.21
Australian mainland	6 ♂♂	18 — 20	18.9 ± 0.27	0.66
	1 ♀		(17.0)	

TABLE 10

Comparison of males with females in the Tasmania-Maatsuyker series of *A. minimus*.

Measurements in millimetres.

		Range	Mean ± S.E.	Standard Deviation
Head-body	11 ♂♂	103 — 122	113.5 ± 1.70	5.65
	11 ♀♀	94 — 117	105.6 ± 2.13	7.05
Pes length	12 ♂♂	16 — 22	18.7 ± 0.4	1.37
	16 ♀♀	17 — 19	18.1 ± 0.3	1.21

TABLE 11

Fusion of first interdigital pad with inner metacarpal (-tarsal) pad on manus and pes in *A. swainsonii* and *A. minimus*.

Fusion	Manus				Pes			
	A. minimus		*A. swainsonii*		*A. minimus*		*A. swainsonii*	
	No. of Spec.	Percent.	No. of Spec.	Percent.	No. of Spec.	Percent.	No. of Spec.	Percent.
On both feet	29	100	73	97	5	17	32	44
On one foot			2	3	4	14	10	14
On neither foot					20	69	31	42

(c) *Pelage*

The texture of the pelage is coarser than in *A. swainsonii*. A distinctive feature of *A. minimus* is a strong antero-posterior differentiation in dorsal colour. The head and shoulders are dark grey, grading into rich yellowish brown on the rump and flanks. The whole is ticked with glints of bronze due to banding of the main pile as in *A. swainsonii*, but in *A. minimus* this is more strongly developed and imparts a grizzled appearance. The dorsum is overlain with glistening black guard hairs. The warm, yellowish brown on the flanks is, however, not diluted with black.

The ventrum is uniform greyish yellow or buff. According to the specimens that we have examined, this ventral infusion of yellow invariably distinguishes *A. minimus* from *A. swainsonii*.

The ear, manus and pes are drab brown, ticked with dull buff. The tail is short-haired, dark brown dorsally and grizzled — due to black and buff elements — and lighter beneath.

XI. SKULL AND DENTITION OF A. MINIMUS

Table 6 provides cranial data of the series from Maatsuyker, Tasmania and the mainland. The Maatsuyker series is included separately, as it represents an isolated population at the southern limit of the species range (see Figure 7). These skulls are relatively uniform in size compared with the Tasmanian series. However, the latter are from a variety of habitats, from near sea level to over 2000 feet. There is close agreement in the corresponding mean values of each measurement and proportion. On this evidence, together with the similarity found with head-body data, the Maatsuyker form is part of the Tasmanian population of *A. minimus*.

The mean values of the measurements of the mainland series suggest that this form has a larger skull, with a proportionately narrower postorbi-

TABLE 12

Comparison of cranial characters of Tasmanian and Australian mainland *A. minimus* (males).

		No. of Specimens	Mean	Standard deviation	P
Basalar Length (B.L.)	Mainland	8	28.23	1.058	< 0.01
	Tasmania	11	26.29	1.597	
Zygomatic Breadth	Mainland	9	17.28	0.629	< 0.001
	Tasmania	11	15.71	0.789	
Palatalar Length	Mainland	9	15.35	0.145	< 0.001
	Tasmania	11	14.45	0.233	
Breadth at M^3	Mainland	9	9.69	0.254	< 0.001
	Tasmania	12	9.08	0.100	
Postorbital Construction/ B.L., as percent.	Mainland	8	26.2	1.046	< 0.001
	Tasmania	11	28.5	0.390	

tal constriction, than its Tasmanian counterpart. Table 12 sets out the results of a comparison of 9 mainland and 12 Tasmanian male specimens. Differences between the two series are very marked and are of high statistical significance, taking into account the small samples. The biological significance of these results is not easily defined; nevertheless, within the limits of the available material the occurrence of a larger form on the mainland has been demonstrated.

Finlayson (*loc. cit.*, p. 149), when commenting on the status

(*Photo: N. A. Wakefield*)

Figure 8: A live male *Antechinus minimus maritimus* from Bridgewater Lakes, Victoria (F.W.D., No. 426).

of the mainland population of *A. minimus* (as *Phascogale swainsoni maritima*) in relation to *A. swainsonii swainsonii* and *A. flavipes*, concluded that *A. minimus* shows minor cranial changes towards *A. flavipes*. A more logical interpretation, now that specific and geographical relationships are better understood, is that less extreme modification has occurred in *A. minimus* than in *A. swainsonii*. (Compare Figures 4 and 6).

In *A. minimus* the rostrum is only moderately elongated. The anterior palatine foramina are conspicuously shorter, reaching back to about level with the middle of P^1. The length of this opening provides an absolute key feature for distinguishing these two closely related species; in the series measured by us, the range and mean for *A. swainsonii* is 4·60 - 6·65 (5·41) mm and for *A. minimus* is 3·30 - 4·40 (3·76) mm. In *A. minimus* the frontal-nasal region of the skull is usually convex as in *A. flavipes;* although occasionally this area is flat, thus approaching the condition of *A. swainsonii*. The postorbital region is parallel-sided, as in *A. swainsonii*.

The teeth of *A. minimus* are of the same pattern as in *A. swainsonii* but as the rostrum is less elongated there is normally no interruption of the upper premolar row by interspaces. The only marked difference is a small distinct metacone* on the M^4 of *A. minimus;* this is absent in *A. swainsonii*. The milk premolars are as in *A. swainsonii* (see Section VI).

*This occurs also in *A. godmani*.

XII. Breeding Condition in A. minimus

Females

In the total series of 25 females, only 3 showed signs of recent breeding activity. Although unoccupied, in each case the pouch area was fully developed and the nipples enlarged. These observations are similar to those recorded for *A. swainsonii*, and it is probable that the timing of breeding and subsequent events is the same in both species.

In all females of *A. minimus minimus* examined (Maatsuyker, 6; Tasmania, 3), the nipple number was six. In our two females of *A. minimus maritimus*, the count was eight. This difference is a parallel to that between *A. swainsonii swainsonii* and *A. swainsonii mimetes*.

Males

It appears that the details recorded for *A. swainsonii* (see Section VII) apply also to *A. minimus*.

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